Space Weather Forecast

Issued on Friday, 03 March 2023 at 12:42 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of Minor/Moderate R1/R2 radio blackouts. Risk of Minor Geomagnetic Storm G1 intervals, probably peaking later in UTC weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been moderate over the past 24 hours, with X-ray flares peaking with a Moderate-class at 02/2116UTC, and again at 03/1032UTC from the largest and most complex sunspot region in the Sun's northwest. The earlier event at least is likely to have been associated with a Coronal Mass Ejection (CME), with imagery pending for the later flare. The 03/1032UTC CME is not thought likely to carry an Earth-directed component at present, but will be analysed once imagery allows. There were nine sunspot regions on the current Sun, with this largest group showing apparent areal decay as it neared the northwestern solar horizon.

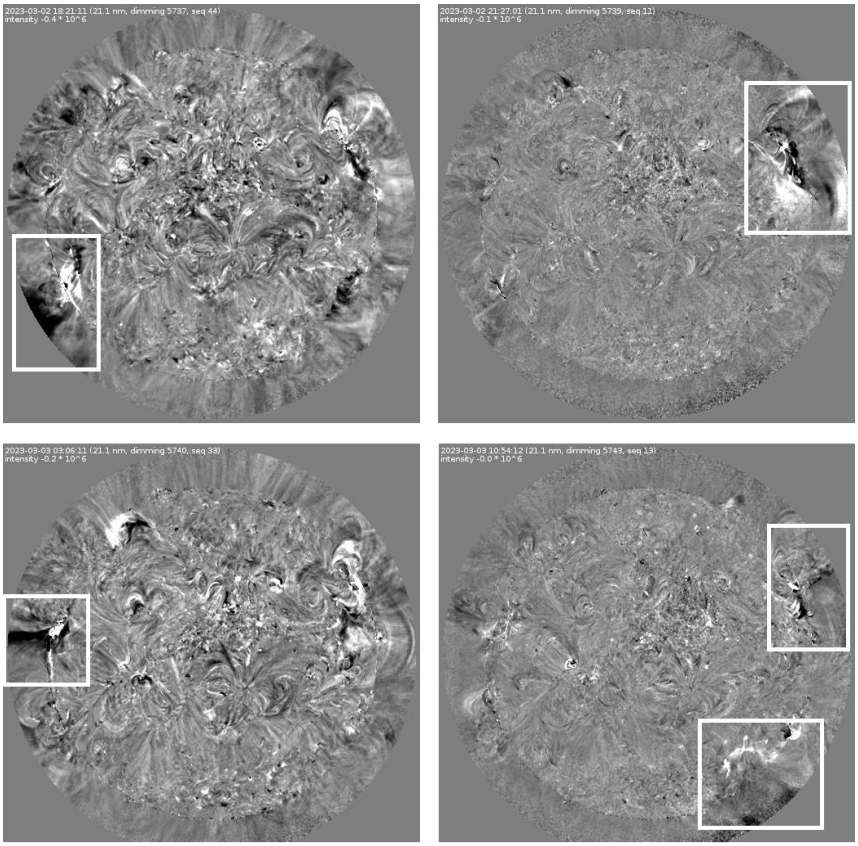

Figure 1: Rogues' gallery of a selection of potential CME-spwaning events in the period, as they appear in time-integrated extreme UV imagery (processing courtesy of SIDC ROB). Note that they are all generated from near the solar horizons and therefore less liable to be Earth-directed (with this to be confirmed once analysis becomes possible).

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Also of note in terms of flares in the period was a high-end Common-class from a newly-arrived eastern hemisphere spot group, which showed as magnetically bipolar, with a spreading tendency and fading of its trailing spots. This event is also considered likely to have produced a CME, with analysis also pending imagery.

Other regions on the Sun mostly comprised small magnetically unipolar regions, with the possible main exception of a new group near the southeastern solar horizon.

As well as the aforementioned flares, other noteworthy CME progenitors in the period included a large 'prominence' and 'filament eruption' (arcs of plasma) from the southeastern horizon, visible on ground-based near-infrared telescope imagery around 02/16-1700UTC. This appears to have taken the form of a slower and subsequent faster pair of CMEs, with both apparently behind and below the track of the Earth in its orbit. The slower of the pair has been analysed and is not likely to affect Earth, with thoughts for the latter provisionally similar. Also of note was a southwestern 'filament eruption' 03/07-0800UTC, which has also yet to be confirmed.

At present then, there are thought to be no new Earth-directed CMEs, although there is limited availability of confirming observations.

Solar Wind / Geomagnetic Activity: The solar wind was likely characteristic of a fast solar wind, which may comprise a combination of a fading wind from one source and perhaps the arrival of a stronger second source.

The solar wind speed initially fell from elevated to slightly elevated levels, before undergoing a resurgence into the current UTC day. The number of particles in the solar wind was mostly at background levels, but did show a brief slight rise immediately prior to the increase in solar wind speed. The associated magnetic field was relatively smooth in character, varying to a peak of slightly elevated levels around the time of the speed increase. The north-south component was more limited in scope, with an overall slight anti-aligned bias with Earth's field, especially in the later stages of Thursday 02 March.

The net effect of the above solar wind measures was for sub-Minor Geomagnetic Storm G1 activity throughout, but coming closest with the main changes in the solar wind between 21 and 03UTC.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of further Moderate X-ray activity, chiefly from the largest sunspot in the Sun's northwest into the UTC weekend. This spot should depart the front side by Sunday 05 March, leaving a tentative decrease in risk, although the sheer number of forecast arriving sunspot regions in the east may arrest or even reverse this decline, with analysis of arrivals pending.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs feature in the forecast. Geomagnetic activity should therefore comprise of an exit from one fast wind - possibly in course or complete - with a second more intense fast wind following. This gives a Slight Chance of Minor Geomagnetic Storm G1 throughout, but peaking with a chance on Sunday 05 March with the posited arrival of the most intense part of the coronal hole.

Energetic Particles / Solar Radiation: Solar radiation carries a peak slight chance of S1 or greater in the immediate term, given the recent Moderate-class flare and the fact that the largest sunspot group eventually rotates away from a peak geoeffective position into the working week.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	20	40	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	50	40	40
Very Active	R3 to R5 X	No	10	10	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	15	10	10	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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